The Clay Research Group

RESEARCH AREAS

Climate Change ◆ Data Analysis ◆ Electrical Resistivity Tomography
Time Domain Reflectometry ◆ BioSciences ◆ Ground Movement
Soil Testing Techniques ◆ Telemetry ◆ Numerical Modelling
Ground Remediation Techniques ◆ Risk Analysis
Mapping ◆ Software Analysis Tools

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October 2013

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Issue 101, October, 2013

The Subsidence Forum

The Subsidence Forum is running a training day on Thursday 17 October at the BRE, Garston, Watford.

It promises to be a worthwhile event, with talks from many senior figures in our industry.

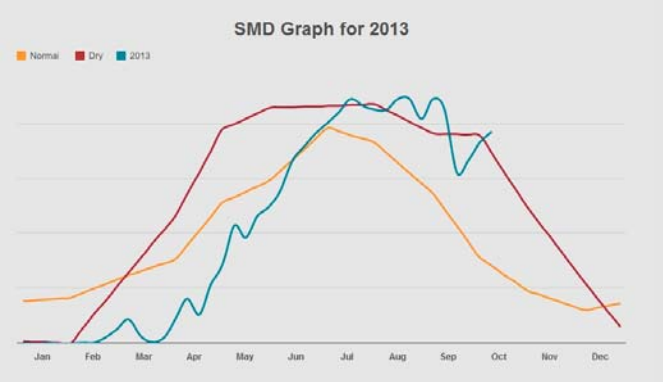
For details and a full program, visit …

http://www.subsidenceforum.org.uk/

Another Odd Year

Another year where the SMD refuses to follow any previous pattern, making prediction very difficult.

The plot below relates to Met Office data for tile 161 (North London), on soil with medium available water capacity and grass cover. We use this to provide information on what the weather is doing and then use specific tree data in the models.



Soil Moisture Deficit data provided by the Met Office

Following a very slow start, with ground at field capacity, the SMD rose sharply in July and the high level deficit was maintained for a few months before falling temporarily, only to rise again more recently.

Readers tell us that claims numbers are at normal levels. As far as we are aware, this late drying hasn't produced a surge, but we await the release of ABI figures to see what has happened.

This will be another interesting year and may help to determine the different effects of early and late drying. Is it the case that roots detecting a moisture deficit as the tree comes into leaf produce a different response to trees where moisture uptake is reduced later in the year?

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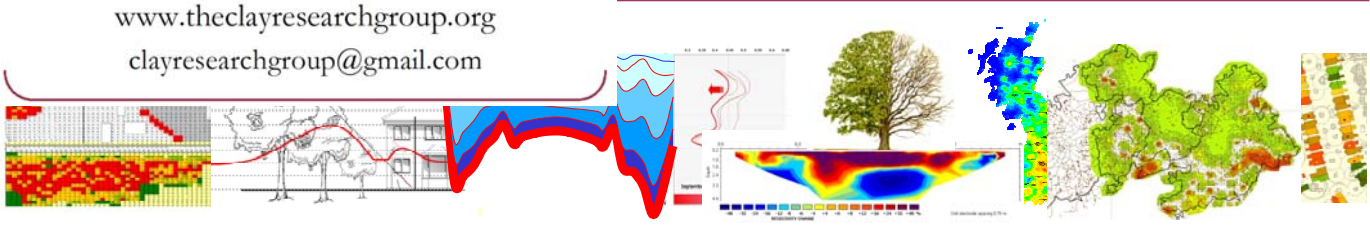

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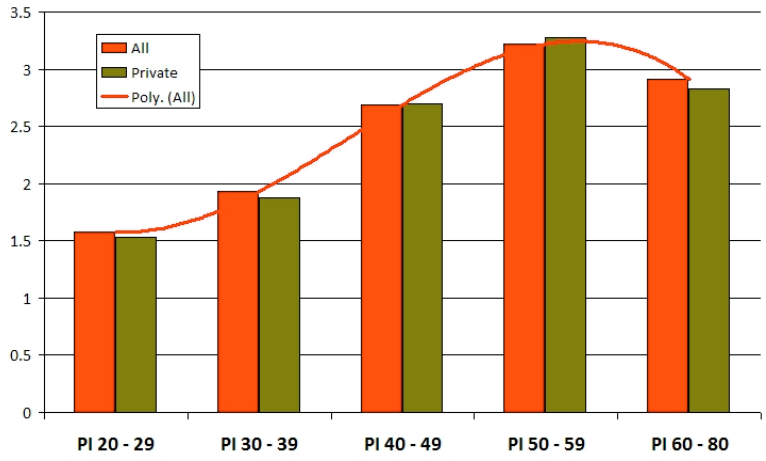
RISK BY SOIL SHRINK/SWELL POTENTIAL

This updated graph showing the relationship between clay soil PI and risk has appeared before, but this version has the increase in risk expressed as frequency of claims divided by both private houses and 'all' – which includes Local Authority and Housing Association.

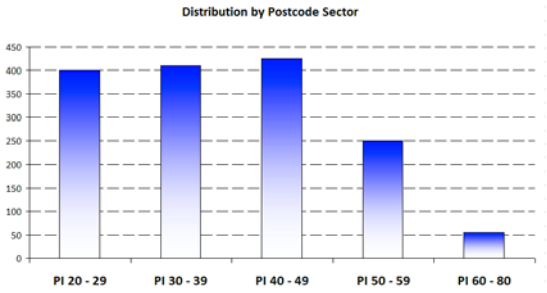
The values have been calculated by using the figure for the UK average including all soils types, and looking at soils with a PI of between 50 – 59% as an example, it can been seen that this soil is over 3 times riskier than the UK average for all soil types.



Soils with a PI of between 30 – 39% are nearly twice as risky as the UK average. The concentration of Local Authority housing makes little difference to the postcode sector risk.

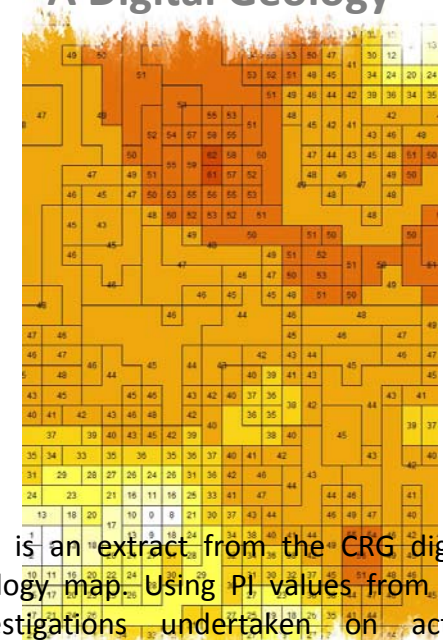
Looking at the distribution of clay soils by postcode sector, we estimate that just over 15% of UK sectors have a PI greater than 20%. Around 18% of sectors have a PI greater than 15%, and in total nearly 20% have a clay fraction, including mixed drift deposits.

DISTRIBUTION BY SOIL SHRINK/SWELL POTENTIAL

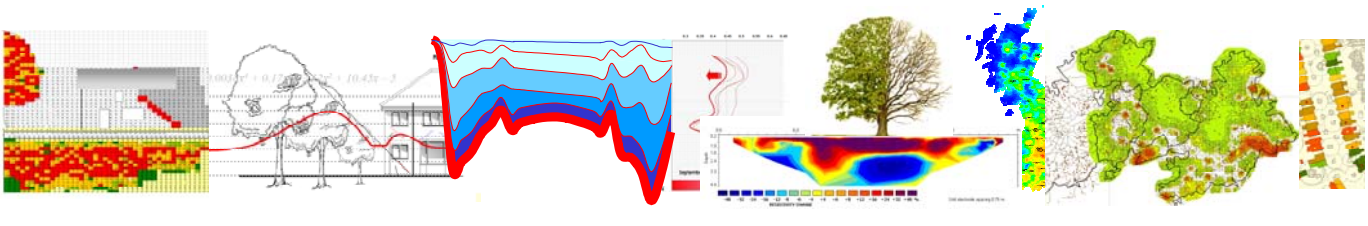


Although the PI category of 50 – 59% covers only 250 sectors (above) it poses the highest risk in terms of claims / properties of any class.

A Digital Geology



This is an extract from the CRG digital geology map. Using PI values from site investigations undertaken on actual claims the data has been mapped onto a 250m grid using interpolated weighted averages.



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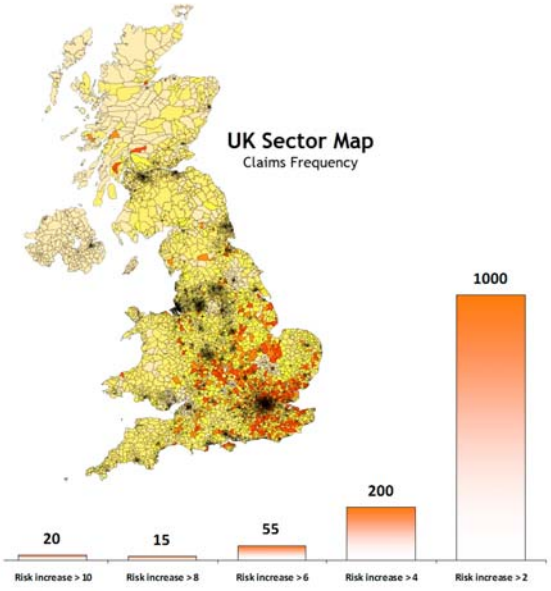
Claim Frequency

Averages and Extremes

An analysis of a claim sample exceeding 100,000 records reveals the vagary of the term, 'average claim frequency'.

The average of the CRG sample is 0.003, or 0.33% - or 3.3 claims per 1,000 houses. This would be representative of an exceptionally busy year with high claim numbers driven by hot, dry weather and vegetation.



If the UK average for our sample is 0.33%, what is the frequency in the higher risk sectors?

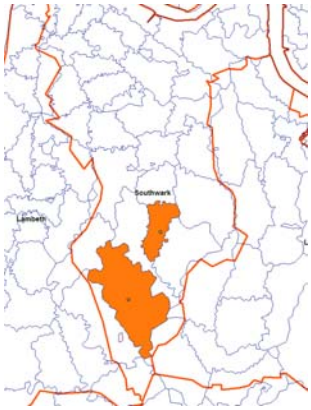
The graph above records that around 1,000 UK postcode sectors have twice as many claims as the average. 200 sectors receive four times as many as the average. A very small percentage (20 sectors) see an increase of x 10 the average.

However this is misleading. 11 of these 20 sectors have fewer than 100 houses, which distorts the analysis when we consider that the average number of houses per sector is 2,500. A single claim in a sector with only 20 houses gives some small village undue prominence in the scheme of things.

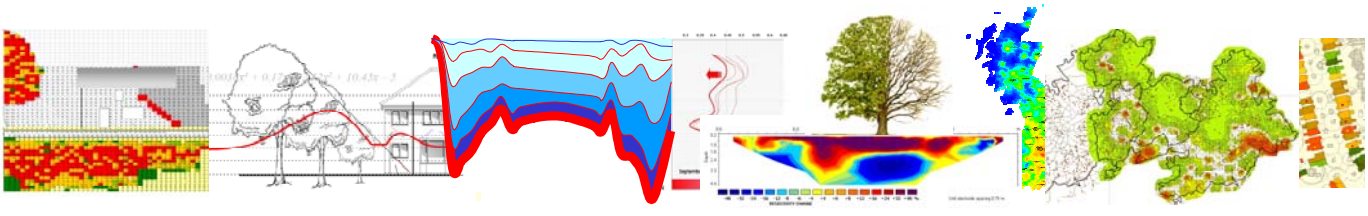
Only 10% of postcode sectors come into the category of 'average'. 60% have a claim frequency less than average, leaving 30% in the 'higher than average' class.

Of the top 1,000 of these high risk sectors, 60% have shrinkable soils with a PI greater than 20%.

Right, the higher risk sectors in North London, and below, a few south of the Thames. These are in the top 20, and all have housing populations greater than 1,200.



The exercise may be useful to adjusters who have to resource for increases in claims in peak periods, rather than underwriters. Selecting the sectors on clay would be useful when handling surge.



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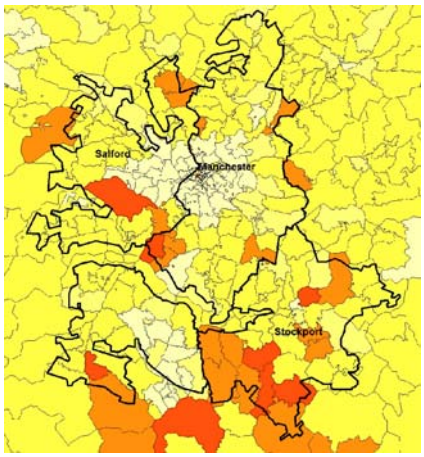
SECTOR RISK, by CITY

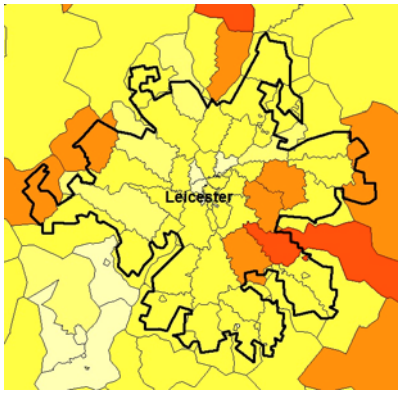
Only 10% of postcode sectors come into the category of 'average'. 60% have a claim frequency less than average, leaving 30% in the 'higher than average' class.



GREATER MANCHESTER

Claim frequencies for a selection of cities to show the 'hot-spots'.

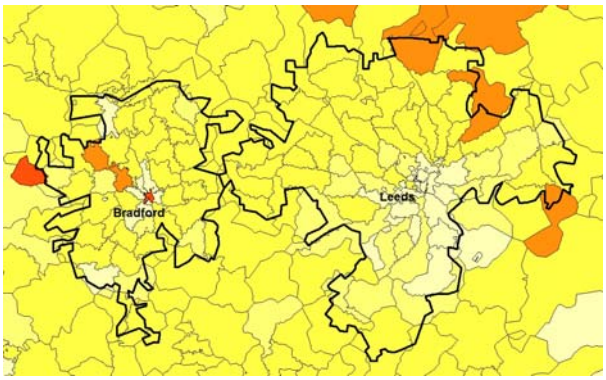
Right, Greater Manchester has a few high risk sectors spread around the periphery, with a concentration to the south of Stockport.

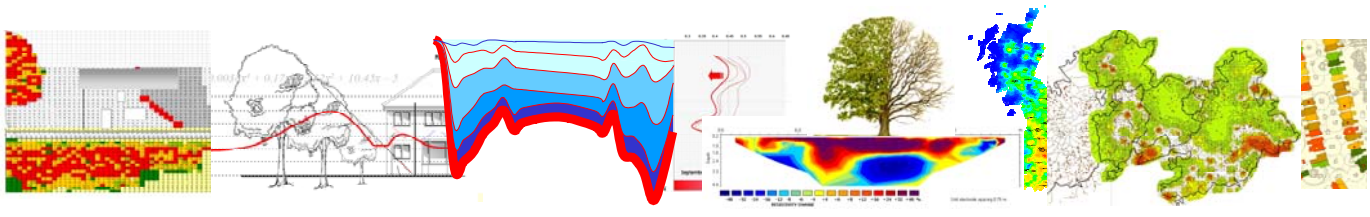


LEICESTER

Left, the frequency risk in Leicester. Again, a few higher risk sectors to the periphery but a concentration of risk towards the south east of the city boundary.

LEEDS & BRADFORD present a lower risk than the cities described above and a few of the 'hot-spots' identify sectors with a very small number of claims and low housing densities.





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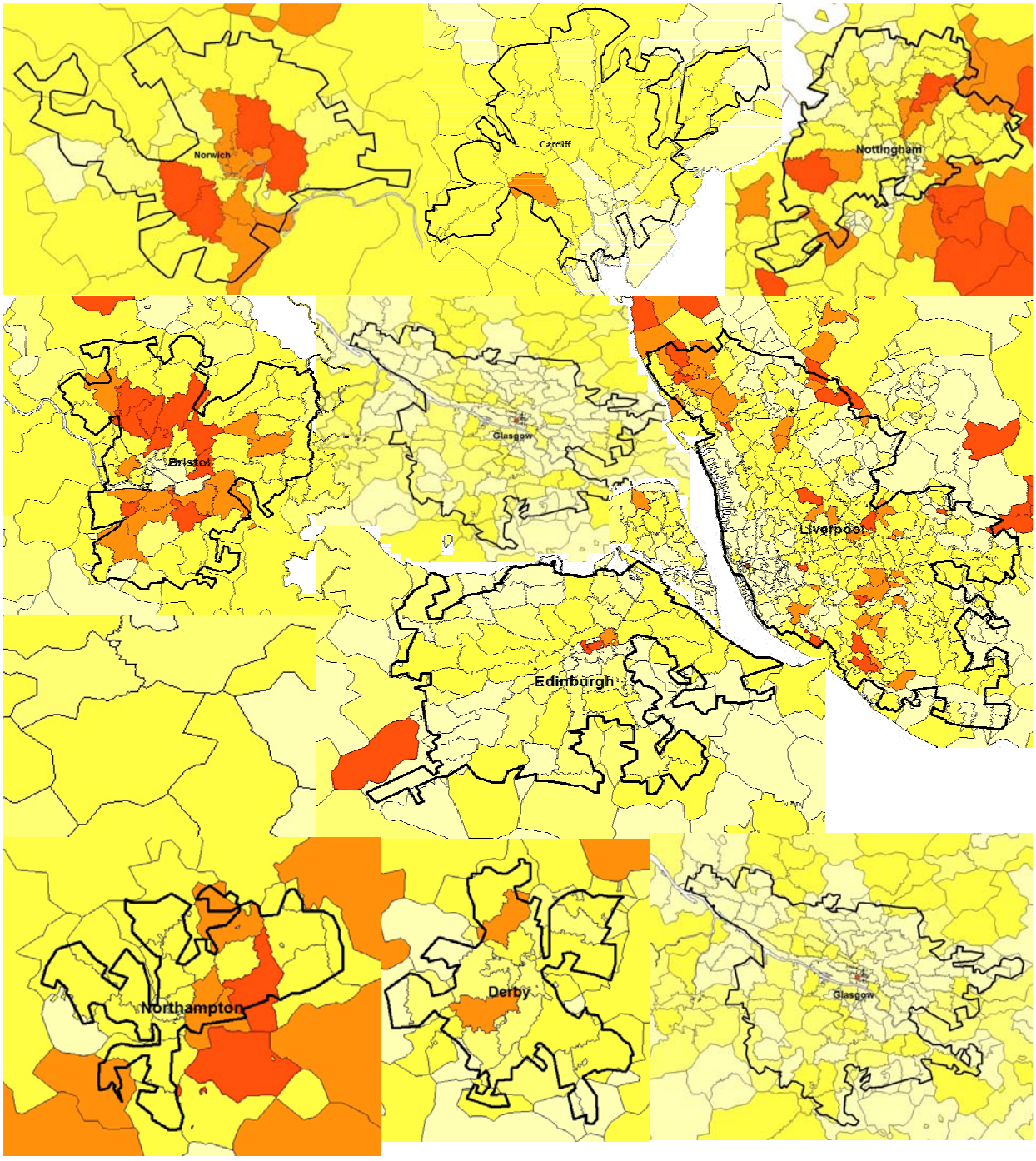
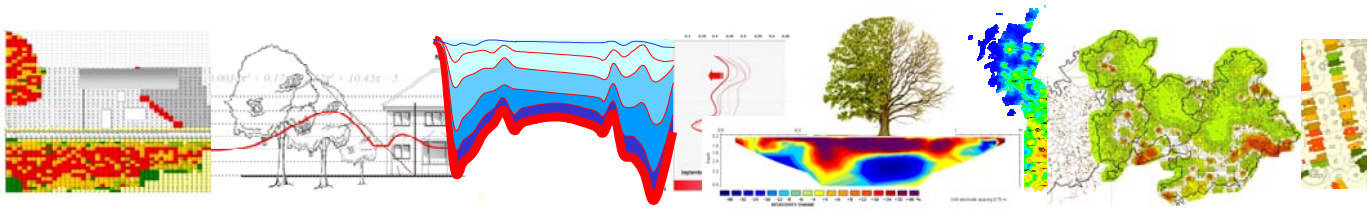
ABOVE AVERAGE RISK, SECTOR LEVEL, CITY by CITY





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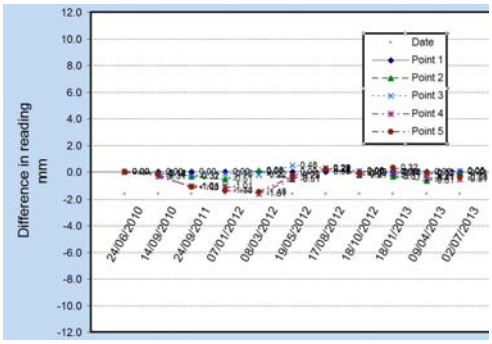
InterTeQ Update Page

None of the 50 or so properties treated using this technique has suffered a recurrence of movement in 2013.

The above property was treated using the InterTeQ method in 2010. It had been damaged on several previous occasions and although there was ample evidence to prove that the problem was root induced clay shrinkage, for one reason or another it proved impossible to remove the surrounding trees – predominantly Oak as can be seen on the site plan above.

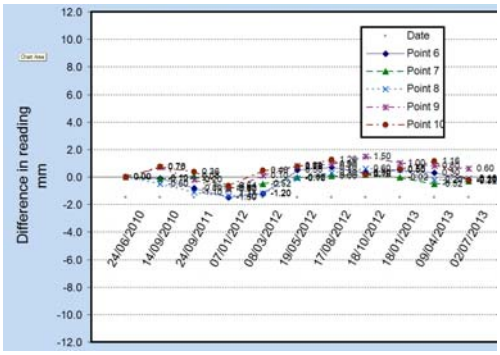
Although the damage wasn't structurally significant, recurrent cracking was becoming a problem. The homeowner was also keen to retain the trees, which formed a dominant feature in the street.

The last set of precise levels were taken at the beginning of July – before the recent spell of sunshine – and seasonal movement has been limited as can be seen on the charts below and well within the limiting tensile strains of masonry.

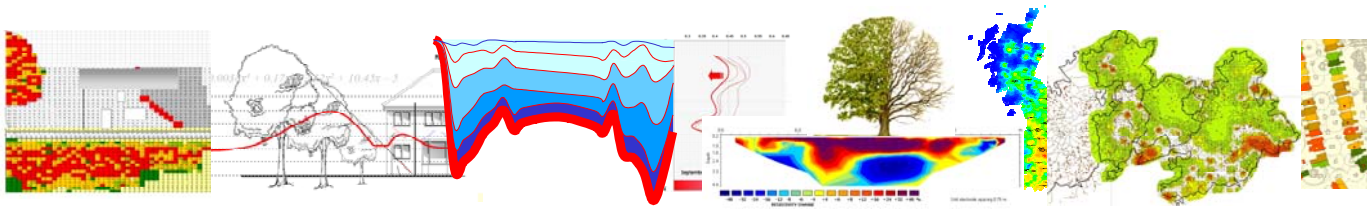


Above (Stations 1 – 5 inclusive) there was maximum 2mm of downward movement in the late summer with a late recovery in Spring of 2012.

Below there has been 4mm of seasonal movement at Stations 6 – 10.



The 'upside down' nature of the readings suggest that they have been plotted against a moving datum, but the relative values remain valid.



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SwissRe Report on Subsidence Risk across Europe

"The Hidden Risks of Climate Change. An Increase in Property Damage from Soil Subsidence in Europe"

A SwissRe report on the risk of subsidence, dated 2011, concludes by suggesting "as incidents of soil subsidence increase in frequency and severity with climate change, so does the need for systematically managing the risks through a combination of loss prevention and risk transfer initiatives, including insurance."

Figure 4, (taken from their paper) illustrates loss potential estimates against base climate data for the period 1987–2006. The map follows the current industry experience with the SE figuring high in the risk tables.

Figure 5 maps the increase in claims (>50%) since 1951–70. Losses appear to have moved north and west, although London is still significant.

Figure 6 seems perverse as much of the perceived threat is apparently related to Climate Change, the South West is not an area with a recognised exposure in hot, dry summers due to the absence of highly shrinkable clay soils.

The report says that "loss experience is not a good indicator of future risks" and arrives at some counter-intuitive findings. Practitioners in the UK understand that clay soils are vulnerable to long periods of hot, dry weather and alluvial soils may be vulnerable to erosion. Lowering of the water table would present a problem in areas of peat.

Figure 4: Loss potential from soil subsidence in Europe today
Loss potential from soil subsidence in Europe today is simulated using a base climate scenario for the period 1987–2006.

Fig 4

Figure 5: Increase in loss potential from soil subsidence since 1951–70
Loss potential from soil subsidence has been rising across Europe. Light green shades denote areas where today's simulated losses increased by more than 50% since the 1951–70 period.

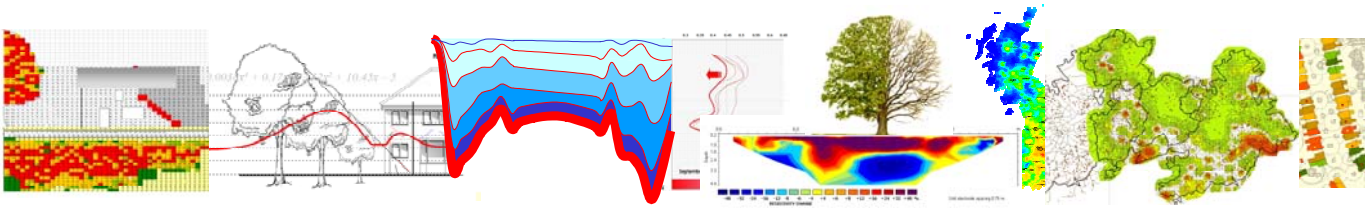
Fig 5

Figure 6: Projected increase in loss potential from soil subsidence by 2021–40
Loss potential from soil subsidence is projected to rise further in a changing climate. Grey shades denote regions where future subsidence losses for the period 2021–2040 are estimated to increase by 50% or more compared to the period 1987–2006.

Fig 6

Wetter weather would certainly increase the risk of landslip, but we have trouble understanding the underlying mechanisms behind the predictions shown in Figure 6.

Certainly the suggestion that historic data isn't a predictor of risk hasn't been the case since the early 1970's, when subsidence cover was first provided. The report is an interesting one, and would have benefited from a fuller discussion around these points, together with references.



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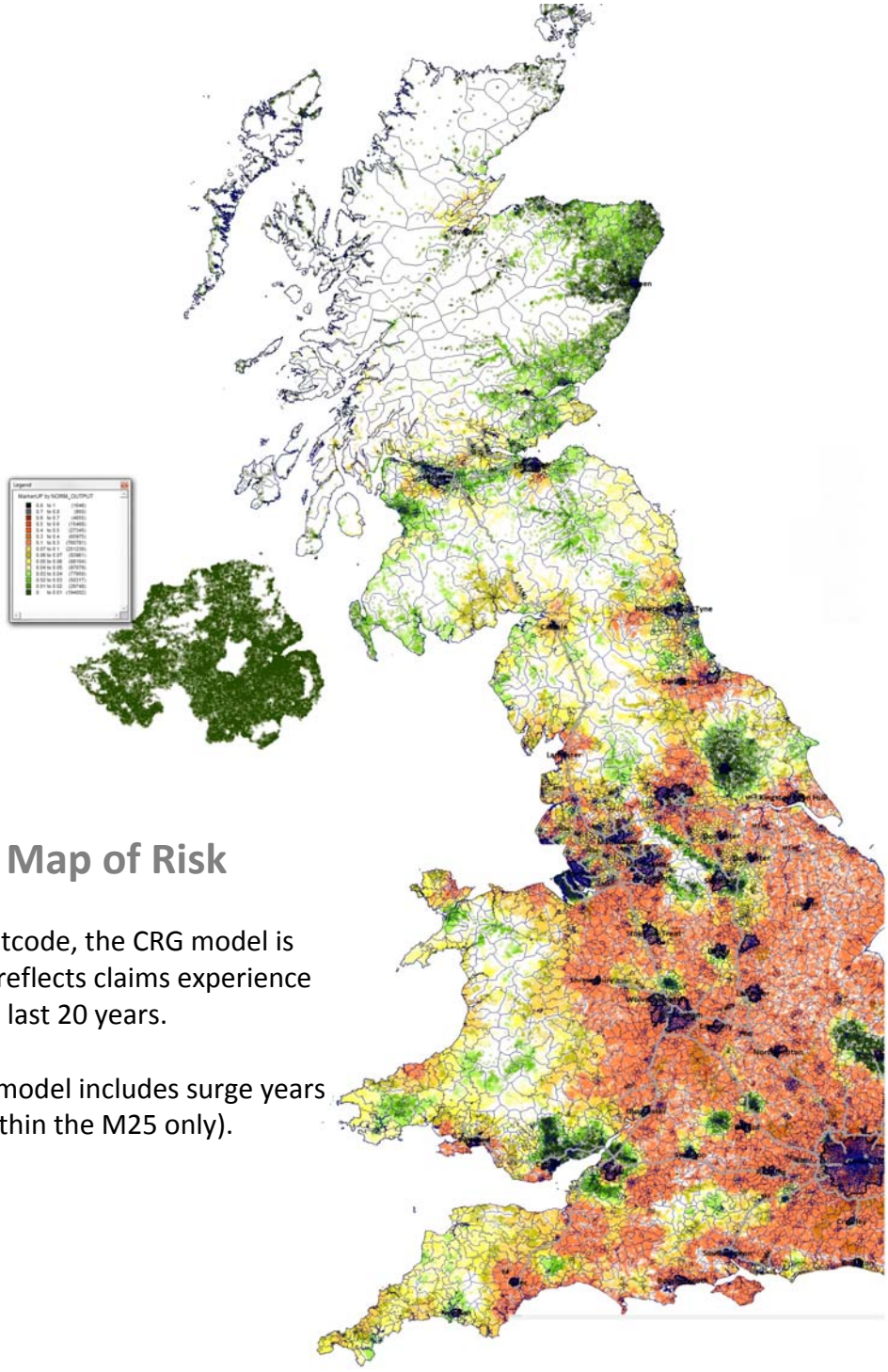
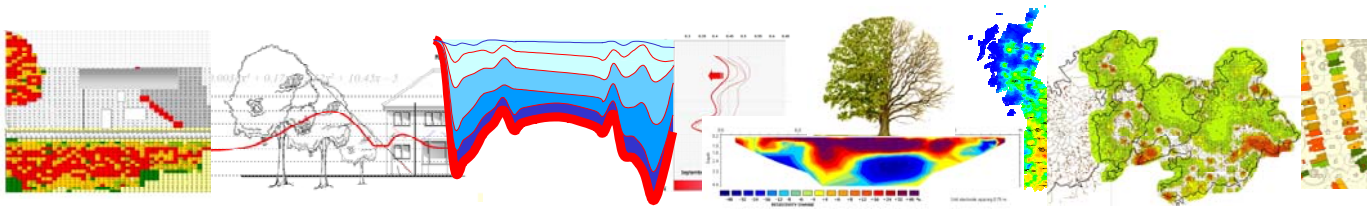


The CRG Map of Risk

Mapped at full postcode, the CRG model is highly granular and reflects claims experience over the last 20 years.

The claim frequency model includes surge years and trees (within the M25 only).



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ANTI-TRANSPIRANTS

A few years ago Professor Bill Davies from Lancaster University suggested that we explore the use of anti transpirants to reduce the moisture uptake of trees.

Professor Davies has published several original papers on the effects of the hormone Abscisic Acid (ABA) as a 'root to shoot' signalling mechanism, and the beneficial influence of Partial Root Drying (PRD).

The problem we foresaw at that time was the prohibitive cost of spraying trees on a weekly basis, and in any event, we had no sway with Local Authorities in terms of applying it.

However, an annual budget of somewhere near £280k per Borough plus the changes in liability presented by Berent have caused us to reconsider this technique. Also, crown reducing tree canopies by 90% every two or three years can't be a sustainable solution with pressures on Local Government to increase canopies to counter carbon emissions.

Antitranspirants are described by Wikipedia as "compounds applied to the leaves of plants to reduce transpiration." There are two categories, metabolic inhibitors and what are known as 'film forming'.

The metabolic inhibitors "reduce the stomatal opening and increase the leaf resistance to water vapour diffusion without affecting carbon dioxide uptake. Examples include phenylmercuric acetate, abscisic acid (ABA), and aspirin."

We see mention of ABA which reinforces the approach – these compounds trigger a response by the tree as opposed to being a mechanical technique. The Intervention Technique is an example of how we hope to trigger a metabolic inhibitor.

For the current exercise we will be looking at film forming anti-transpirants. Wikipedia describes these as "These form a colorless film on the leaf surface that allows diffusion of gases but not of water vapour. Examples include silicone oil and waxes "

In some instances, depending on the substance used, spraying the leaves results in cooling which reduces transpiration.

Commercial sprays usually consist of polymers sprayed as emulsions in water and include hydrocarbons, terpenoids and latex. They are available in proprietory forms (VaporGard, Moisturin, Wiltpruf etc.).

A review of published literature suggests that antitranspirants are of value for situations where photosynthesis is not important but where reduction in water loss is beneficial. The state of maturity of the plant is also significant in terms of benefit delivered.

Currently, anti-transpirants are used primarily for treating plants, agricultural crop and small trees - particularly Christmas trees where the tree is severed from the roots, and needle drop is an issue. Here their use keeps the tree in a state of suspended animation for several weeks.